

Patent Application
NC 84,352

Amendments of the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

Claim 1 (currently amended): A product that is essentially devoid of a sintering aid and its components, said product comprising spinel that has porosity of less than 0.2 %, said spinel is transparent to light having wavelengths in the range of 0.3-5.5 microns and said spinel having transparency in excess of 50 % for a thickness of 1 mm, its spinel grains are within about 300% of the size of an average grain and is devoid of grains larger than about 1 mm.

Claim 2 (canceled)

Claim 3 (canceled)

Claim 2 (canceled)

Claim 4 (previously amended) . The product of claim 1 devoid of grains of exaggerated size having transparency of at least 60 % for a 1 mm thickness at a wavelength of 4 microns and said product is a hard crystalline solid selected from the group consisting of oxides of magnesium and aluminum.

/ Claim 5 (previously amended) The product of claim 2 1 having transparency of at least 60 % for a 1 mm thickness at a wavelength

Patent Application
NC 84,352

of 4.0 μm and the spinel is a hard crystalline solid MgAl_2O_4 .

Claim 6 (withdrawn). A process for preparing a transparent ceramic product comprising the steps of:

(a) dissolving a sintering aid in a suitable solvent to form a sintering aid solution,

(b) applying the sintering aid solution to ceramic particles to form a ceramic dispersion,

(c) sub-dividing the ceramic dispersion to form droplets comprising at least one ceramic particle coated with the sintering aid solution,

(d) drying the droplets to form dried coated particles comprising at least one ceramic particle coated with a dried layer of the sintering aid, and

(e) densifying the dried coated particles to form a transparent ceramic product having uniform optical and mechanical properties and being devoid of grains larger than about 1 mm and grains of exaggerated size.

Claim 7 (withdrawn). The process of claim 6 wherein said densifying step is carried by applying minimal pressure of about 50 psi to the coated particles while raising temperature to above the melting temperature of the sintering aid and pressing the dried coated particles at above about 5000 psi while increasing temperature to above about 1500°C.

Patent Application
NC 84,352

Claim 8 (withdrawn). The process of claim 6 wherein said ceramic particles are spinel $MgAl_2O_4$, wherein said densifying step is accomplished in a hot press by ramping temperature from ambient to above $1500^{\circ}C$.

Claim 9 (withdrawn). The process of claim 6 wherein said ceramic particles are spinel $MgAl_2O_4$, and wherein said densifying step is accomplished by ramping steps to an elevated temperature with intermittent holding periods to allow the sintering aid to liquify and escape.

Claim 10 (withdrawn). The process of claim 9 wherein the ramping steps are about $20^{\circ}C/minute$ and the holding periods are between the ramping steps and are about one half hour.

Claim 11 (withdrawn). The process of claim 10 wherein there is an initial ramping step to a temperature of less than $100^{\circ}C$ above the melting point of the sintering aid followed by a holding period to liquify the sintering aid, an intermediate step to less than about $550^{\circ}C$ above the melting point of the sintering aid, followed by a holding period to allow vaporized sintering aid or components thereof to escape, and a final ramping step to above $1500^{\circ}C$, followed by a holding period to fully densify the dried coated particles to a transparent spinel product.

Claim 12 (withdrawn). The process of claim 8 wherein the spinel particles making the spinel dispersion have particle size in the

Patent Application
NC 84,352

range of 500nm to 100 μ m; wherein the solvent includes water and an additive selected from the group consisting of ethanol, isopropanol, and mixtures thereof; and the ratio of water to hydrocarbon to LiF sintering aid to spinel particles is about 220 ml, about 780 ml, 0.2 grams, and 10 grams, respectively.

Claim 13 (withdrawn). The process of claim 12 wherein pH of the final sintering aid solution is about 7.

Claim 14 (withdrawn). A process for preparing a transparent $MgAl_2O_4$ spinel product having maximum transparency in excess of about 60% comprising the steps of :

(a) dissolving LiF sintering aid in water to form a sintering aid solution of about a neutral pH,

(b) mixing the sintering aid solution and a volatile, low surface tension/viscosity additive selected from the group consisting of ethanol, isopropanol, and mixtures thereof ,

(c) applying the sintering aid solution to $MgAl_2O_4$ spinel particles to form a spinel dispersion,

(d) atomizing the spinel dispersion to form droplets comprising at least one spinel particle coated with the final spinel solution,

(e) drying the droplets to form dried coated particles comprising at least one spinel particle coated with a dried layer of the sintering aid, and

Patent Application
NC 84,352

(f) densifying the dried coated particles to form a transparent MgAl_2O_4 spinel product having uniform optical and mechanical properties in absence of grains of exaggerated size.

Claim 15 (withdrawn). The process of claim 14 wherein said densifying step is accomplished in a hot press by ramping temperature from ambient to above about 1500°C .

Claim 16 (withdrawn). The process of claim 15 wherein said densifying step is accomplished by ramping steps to an elevated temperature with intermittent holding periods to allow the sintering aid to liquify and escape.

Claim 17 (withdrawn). The process of claim 17 wherein the ramping steps are about $20^\circ\text{C}/\text{minute}$ and the holding periods are between the ramping steps and are about one half hour.

Claim 18 (withdrawn). The process of claim 17 wherein there is an initial ramping step to a temperature of about 950°C followed by a holding period to liquify the sintering aid, an intermediate ramping step to about 1200°C , followed by a holding period to allow vaporized sintering aid to escape, and a final ramping step to above 1500°C , followed by a holding period to fully densify the dried coated particles to a transparent spinel product.

Claim 19 (previously added)): A magnesium aluminate spinel sintered product that is essentially devoid of a sintering aid and its components, that has porosity of less than 0.2%, has uniform

Patent Application
NC 84,352

grain size wherein the grains are less than 300% of the average grain size and is devoid of grains larger than about 1mm.

Claim 20 (previously added)): The product of claim 19 having transparency in excess of 50 % for a thickness of 1 mm to light of 0.3-5.5 μm wavelength.

Claim 21 (canceled))